SPECIFICATION

BE IT KNOWN THAT I, MONTIE H. MINER, a citizen of the United States and resident of the County of Madison, State of Illinois have invented certain new and useful improvements in POWER TOOL DRIVES of which the following is a specification, reference being made to the accompanying drawings forming a part thereof.

This invention relates to power tools.

Applicant is the coinventor of a power tool for which United States Patent No. 5,450,773 issued on September 19, 1995, and which employs a high-speed motor to drive a yoke which in turn drives a rotatable gear through biased pawls mounted in the yoke. Applicant has developed and achieved a reversible yoke, pawl and gear combination which is so designed and constructed that maximum power and torque are transferred from the yoke to the gear, and wear on the pawl and gear teeth is minimized, thereby yielding a reversible power tool which is efficient, and has a substantially longer use life.

It is the object of this invention to provide a yoke, gear and pawl combination which is durable, efficient, powerful, longer lasting, and usable on all power tools.

IN THE DRAWINGS

FIG. 1 is a top view of a preferred embodiment of my invention.

FIG. 2 is a sectional view taken along lines 2-2 of Figure 1.

FIG. 3 is a sectional view taken along lines 3-3 of Figure 2.

FIG. 4 is an enlarged view of the right pawl in the yoke as shown in Figure 3.

FIG. 5 is an enlarged view of the left pawl in the yoke as shown in Figure 3.

FIG. 6 is an enlarged view of several gear teeth T.

FIG. 7 is an enlarged end view of left pawl L.

FIG. 8 is a side view of FIG. 7.

FIG. 9 is an enlarged end view of right pawl R.

FIG. 10 is a side view of FIG. 9.

FIG. 11 is a top view of my yoke Y.

FIG. 12 is a sectional view taken along lines 12-12 of FIG. 11.

FIG. 13 is a sectional view taken along lines 13-13 of FIG. 11.

FIG. 14 shows the relative positions of the yoke, gear and right pawl during the start of powered movement.

FIG. 15 shows the relative positions of the yoke, gear and right pawl as engagement commences.

FIG. 16 shows the relative positions of the yoke, gear and right pawl as the pawl is about to seat itself between adjacent gear teeth.

FIG. 17 shows the relative positions of the yoke, gear and right pawl when the pawl is fully seated and rotational drive power is applied.

DESCRIPTION

Referring now in more detail, and by reference character to the drawings which illustrate a preferred embodiment of our invention, Y designates a yoke in which a gear G is rotatably disposed and complementary pawls L and R are pivotally disposed, L

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representing the pawl on the left and R representing the pawl on the right.

The gear G comprises a plurality of outwardly presented teeth T, each equally spaced from its adjacent teeth about the entire periphery of the gear G. Each tooth T includes flat faces 20, 22, a rounded tip 24 at its outer extremity, and a rounded valley 26 where adjacent teeth T intersect. The radius defining the rounded tip 24 is substantially smaller than the radius defining the rounded valley 26 whereby the open angle 28 between the adjacent teeth T, T', is substantially larger than the angle 38 between the faces 20, 22, as can best be seen in Figure 6, all for purposes presently more fully to appear.

The left pawl L comprises an elongated rod 40 provided with an outwardly extending wing 42. The rod 40 is cylindrical except where the wing 42 projects outwardly therefrom. The wing 42 has an outer face 44 which is flat and tangential to the cylindrical surface of the rod 40 and an inner face 46 which intersects the cylindrical surface of the rod 40. A pair of differently sized teeth 48, 50, are provided at the outer end of the wing 42, the tooth 48 being sized for snug fitting disposition between faces 22, 20' of adjacent teeth T, T', of the gear G, and the tooth 50 being sized smaller in width and length than the tooth 48, and also including a flat face 52 which is sized and located for flushwise disposition against face 20 of the tooth T when the tooth 48 is snugly disposed between adjacent gear teeth T, T'.

Similarly, the right pawl R comprises an elongated rod 60 provided with an outwardly extending wing 62. The rod 60 is cylindrical except where the wing 62

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projects outwardly therefrom. The wing 62 has an outer face 64 which is flat and tangential to the cylindrical surface of the rod 60 and an inner face 66 which intersects the cylindrical surface of the rod 60. A pair of differently sized teeth 68, 70, are provided at the outer end of the wing 62, the tooth 68 being sized for snug fitting disposition between faces 22, 20' of adjacent teeth T, T', of the gear G, and the tooth 70 being sized smaller in width and length than the tooth 68, and also including a flat face 72 which is sized and located for flushwise disposition against face 20' of the tooth T' when the tooth 68 is snugly disposed between gear teeth T, T'.

The yoke Y comprises a solid member 80 provided at one end with a crank receiving recess 82 sized for receiving a conventional driving crank (not shown) and at the other end with a bore 84 sized for having the gear G rotatably disposed therein. The member 80 is also provided with a left chamber 86 and a right chamber 88, each being accessible from the top and sized for receiving left pawl L and right pawl R respectively. The chambers 86, 88, each open into the bore 84 whereby the pawls L and R may each engage the gear G from their respective chambers. Provided along the top of the yoke Y is a recessed annular shoulder 90.

The left chamber 86 has a flat base 92, an arcuate wall 94 sized for retaining in close fitting disposition the cylindrical rod 40 as the pawl L is pivoted, an outer wall 96 which tangentially intersects the arcuate wall 94, and a flat inner wall 98 which also intersects the arcuate wall 94. It should be here noted that the angle at the junction between the inner wall 98 and the cylindrical wall 94 equals the angle at the intersection

of the cylindrical rod 40 and the inner face 46 of the left pawl L, such that when the pawl L is seated in the chamber 86 and pivoted fully inwardly, the inner face 46 of the pawl L is in flushwise engagement with the inner wall 98 of the chamber 86 and arcuate wall 94 of the chamber 86 is in flushwise engagement with a substantial portion of the cylindrical rod 40, all for purposes soon to appear.

Similarly, the right chamber 88 has a flat base 102, an arcuate wall 104 sized for retaining in close fitting disposition the cylindrical rod 60 as the pawl R is pivoted, an outer wall 106 which tangentially intersects the arcuate wall 104, and a flat inner wall 108 which also intersects the arcuate wall 104. It should be here noted that the angle of the junction between the inner wall 108 and the cylindrical wall 104 equals the angle at the intersection of the cylindrical rod 60 and the inner face 66 of the right pawl R, such that when the pawl R is seated in the chamber 88 and pivoted fully inwardly, the inner face 66 of the pawl R is in flushwise engagement with the inner wall of the chamber 88 and arcuate wall 104 of the chamber 88 is in flushwise engagement with a substantial portion of the cylindrical rod 60, all for purposes soon to appear.

The pawls L and R are lengthwise sized so that each will extend from the base of their respective chambers 86, 88, into the recess 90 and to the top of the yoke Y. The gear G is sized so that its upper surface is co-planar with the shoulder 90. A selectively positionable directional control D (partially shown) including an arcuate shoulder 110 with a flat segment 112 is positioned in the recess 90 in such manner that no two pawls engage the gear G at the same time, but only one of the pawls L, R, may engage the gear

teeth T at any given time when the segment 112 spans its respective chamber 86, 88. A biasing spring 114 mounted on the left side of the yoke Y and extending into the chamber 86 urges the left pawl L to pivot in the chamber 86 toward the inner wall 98. A second biasing spring 116 mounted on the right side of the yoke Y and extending into the chamber 106 urges the right pawl R to pivot in the chamber 86 toward the inner wall 108.

OPERATION

In use, the yoke Y, gear G, pawls L, R, and directional control D are operatively mounted on a power tool in a manner similar to that shown in United States Patent No. 5,450,773. To illustrate, the directional control D is positioned in the recess in such manner that the right pawl R is exposed to the gear teeth T and the left pawl L is held back against the outer wall 94 of the chamber 86 and away from the gear teeth T by the shoulder 110. Referring now to Figs. 14 through 17 inclusive, the operational position of the pawl R and the teeth T, T', is shown as the right pawl R is pivoted toward the inner wall 108 during the powered stoke of the yoke Y. Referring to Fig. 14, we see the yoke Y being moved in a counterclockwise direction, and the tooth 70 sliding over the end of the gear tooth T" as it is moved toward the tooth T'. The shorter length and rounded edge of the tooth 70 allow it to slide without interference around the tooth T". Referring to Fig. 15, as the tooth 70 of pawl P slides along the edge of the tooth T", tooth 70 urges the tooth T' toward its desired position between the teeth 68, 70. Referring now to Fig. 16, the teeth 68, 70, are contacting teeth T", T', respectively, and the tooth 68 is positioned for seating itself snugly in the space between adjacent gear teeth T', T, as the powered

stroke proceeds. Referring now to the final Fig.17, the pawl R is properly seated between adjacent teeth T', T, in which position both faces of the tooth 68 are in flushwise engagement with the gear teeth T, T', and the face of the tooth 70 is in flushwise engagement with the tooth T', in which seated position the teeth 68, 70 remain for most of the powered stroke. Once pawl R is seated, the power stroke continues and there is no movement between the faces of the gear teeth and pawl teeth. No movement equates to no wear under most of the load. Since there is little load while the pawl teeth are being positioned, the life cycle of the tool is increased by at least a factor of four.

The unique and novel structure of the pawl teeth 68, 70, also eliminate jamming and interference on the return stroke of the yoke Y as shown sequentially in Figs. 17, 16, 15 and 14. As the yoke return stroke progresses, the face of the larger pawl tooth 68 which is seated against the face 20 of the tooth T slides upwardly along the tooth T and is caused to be pivoted away from the tooth T by the outer end 24 of the tooth T until the pawl R is pivoted fully away from the tooth T, and the only part of the pawl R which contacts the teeth T of the gear G is the pawl tooth 70. There is no sliding contact under load on the driving face of the tooth 68 because that force is not applied until the tooth 68 is seated between adjacent gear teeth. No contact under load means minimum wear.

A second benefit relates to torque efficiency. There is solid contact between the yoke Y and the cylindrical portions of the pawls R, L, and simultaneously there is direct contact between the teeth of the pawls R, L, and the gear teeth T, T' during the power stroke, wherein the gear G being driven is snugly backloaded against the yoke Y. The

cranking power applied to the yoke is thereby transferred directly to the gear G because of the aforementioned backloading. This feature is a substantial improvement over the present state of the art where spring biased devices reduce the torque that should be applied to the work.

A third distinguishing feature over the present art is the stability provided by the unique and novel construction of the chambers 86, 88, and their respective pawls L, R. The arcuate wall 94 of the chamber 86 is sized to accept in close fitting but pivotal relationship the cylindrical rod 40 of the pawl L. Similarly, the arcuate wall 104 of the chamber 88 is sized to accept in close fitting but pivotally movable relationship the cylindrical rod 60 of the pawl R. The aforementioned interrelationships greatly reduce and in almost all cases reduce the wobble usually encountered as pneumatic tools are powered up to high speeds. If the speeds encountered are such that wobble might be a concern, that wobble can be eliminated by appropriate bores in the pawls L, R, and posts in the chambers 86, 88, without departing from the nature and principle of my invention.

Applicant points out that the unique and novel construction of the pawl and gear in which the angle between opposing faces of the same gear tooth is less than the angle between adjacent gear teeth, and in which the pawl tooth which first comes into contact with the gear is shorter and narrower than the other pawl tooth which becomes snugly seated between gear teeth, is a major part of this invention and produces the previously described benefits.

It should be noted that changes and modifications to the various parts,

components, structures and combinations shown herein made be made and substituted without departing from the nature and principle of my invention.

Having thus described my invention, what I claim and desire to secure by letters patent is shown in the drawings, described in the specification and recited in the following claims.

I claim: